Psychiatric outcome at least 20 years after trauma: A survey on the status of subjective general health and psychiatric symptoms with a focus on posttraumatic stress disorder

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Abstract: BACKGROUND Information on long-term psychiatric sequelae after severe trauma is sparse. We therefore performed a survey addressing several symptoms related to post traumatic stress disorder (PTSD) in patients that sustained multiple injuries more than 20 years after trauma. METHODS Patients injured between January 1, 1973 and December 31, 1990 were contacted at least 20 years later. We included multiply injured patients aged between 3 and 60 years of age from a single level I Trauma center. A questionnaire based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) diagnostic criteria for PTSD, including individual symptoms related to intrusion, avoidance, and hyperarousal was sent to all patients. RESULTS 359 (56.35%) patients received a questionnaire. Out of these, 337 (93.87%) returned the questionnaire and were included in the study (223 males (66.17%) and 114 females (33.82%)). Mean follow-up was 29.5 ± 8.5 years. Nearly half the study population (47.18%) experienced lasting psychiatric sequelae, such as intrusive recollection (n= 65, 19.28%), avoidance (n= 92, 27.29%), or hyperarousal (n=95, 28.18%) at least monthly. Ten patients (2.96%) fulfilled all DSM-IV diagnostic criteria for PTSD. A total of 131 (38.87%) patients reported fair or poor general health status. There was no difference in injury severity in patients with or without PTSD (Injury Severity Score (ISS) 18.33 vs. 20.36, respectively, p = 0.52) or PTSD-related symptoms including intrusion (19.88 vs. 20.32, p=0.74), avoidance (19.99 vs. 20.3, p=0.79) and hyperarousal (19.36 vs. 20.68, p=0.26). CONCLUSION At least 20 years after injury, no correlation was found between the development of psychiatric complications and the severity of injury. While the rate of full-blown PTSD was low, nearly half the study population regularly suffered from at least one psychiatric symptom attributable to the initial trauma. Awareness for the development of psychiatric complications and early initiation of psychiatric counseling is advisable. LEVEL OF EVIDENCE Level II, Prognostic and Epidemiologic.

DOI: https://doi.org/10.1097/TA.0000000000002232

symptoms with a focus on posttraumatic stress disorder. Journal of Trauma and Acute Care Surgery, 86(6):1027-1032.
DOI: https://doi.org/10.1097/TA.0000000000002232

Journal of Trauma and Acute Care Surgery, Publish Ahead of Print
DOI: 10.1097/TA.0000000000002232

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Conflict of interest statement

None of the authors have any conflicts of interests to declare. The authors received no pharmaceutical or industrial support for this study. No further direct or indirect financial support or other assets were transferred to the authors or their family members for this study.

Presentation

These results were presented in the 77th Annual Meeting of AAST and Clinical Congress of Acute Care Surgery and 4th World Trauma Congress; WTC Oral Presentation for AAST20180021.

Funding

For the present 20-year follow-up, institutional funding was used. No further funding sources were utilized.

Background

Information on long-term psychiatric sequelae after severe trauma is sparse. We therefore performed a survey addressing several symptoms related to post traumatic stress disorder (PTSD) in patients that sustained multiple injuries more than 20 years after trauma.

Methods

Patients injured between January 1, 1973 and December 31, 1990 were contacted at least 20 years later. We included multiply injured patients aged between 3 and 60 years of age from a single level I Trauma center. A questionnaire based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) diagnostic criteria for PTSD, including individual symptoms related to intrusion, avoidance, and hyperarousal was sent to all patients.

Results

359 (56.35%) patients received a questionnaire. Out of these, 337 (93.87%) returned the questionnaire and were included in the study (223 males (66.17%) and 114 females (33.82%)). Mean follow-up was 29.5 ± 8.5 years. Nearly half the study population (47.18%) experienced lasting psychiatric sequelae, such as intrusive recollection (n= 65, 19.28%), avoidance (n= 92, 27.29%), or hyperarousal (n=95, 28.18%) at least monthly. Ten patients (2.96%) fulfilled all DSM-IV diagnostic criteria for PTSD. A total of 131 (38.87%) patients reported fair or poor general health status. There was no difference in injury severity in patients with or without PTSD (Injury Severity Score (ISS) 18.33 vs. 20.36, respectively, p = 0.52) or PTSD-related symptoms including intrusion (19.88 vs. 20.32, p=0.74), avoidance (19.99 vs. 20.3, p=0.79) and hyperarousal (19.36 vs. 20.68, p=0.26).

Conclusion

At least 20 years after injury, no correlation was found between the development of psychiatric complications and the severity of injury. While the rate of full-blown PTSD was low, nearly half the study population regularly suffered from at least one psychiatric

symptom attributable to the initial trauma. Awareness for the development of psychiatric complications and early initiation of psychiatric counseling is advisable.

Level of Evidence

Level II, Prognostic and Epidemiologic

Keywords

PTSD, Long-term follow-up, severe injury, multiple trauma, psychiatric complication, intrusion, avoidance, arousal

Background

After severe trauma, patients may suffer from psychological, psychiatric, cognitive and/or behavioral disabilities (1). Severely injured patients are prone to develop psychiatric diseases and mental disorders with higher rates of suicide or additional traumatic events when compared to the general population (2, 3). In addition, psychiatric disorders, such as depression, anxiety or posttraumatic stress disorder (PTSD) may interfere with the physical rehabilitation process in these patient groups. Patients who exhibited a higher sense of self-efficacy showed improved outcomes and rehabilitation results (4). Finally, family involvement in the rehabilitation process also appears to show positive effects on outcome (5). Our group has previously performed a 10-year follow-up survey to assess long-term psychological and general quality of life (6). The survey confirmed that patients with injuries to the lower extremities or intra-articular fractures were significantly more likely to experience poor outcomes (7, 8). Moreover, traumatic brain injuries and spinal cord injuries were independent predictors of long-term disability (2, 9, 10).

The aim of the current 20-year follow-up study was to answer the following questions:

1. Is the severity of multiple injured patients associated with the development of PTSD or PTSD-related symptoms, such as intrusion, avoidance or arousal?
2. Are psychiatric problems and subjective perception of general health associated with injury distribution or injury severity?

Methods

Ethical considerations

This study was conducted according to the declaration of Helsinki (11). The local Ethic Committee approved this study (Ethical Committee Trial ID-Number 2325-200/03/22). Participants who consented to participate in this study were included.

Study Population

In our previous studies (12, 13) a database was established to allow for long-term follow-up. Utilizing an exhaustive recruitment process with multiple steps to find patients that had moved (6, 14), patients treated between January 1, 1973 and December 31, 1990 at a single level 1 trauma center were contacted. All patients were contacted by phone or mail prior to sending out the questionnaire. With a returned questionnaire, patients consented to participate and were included in this study. This investigation was designed as a prospective cohort study. All multiply injured patients between 3-60 years of age with a minimum follow-up of 20 years and a properly completed questionnaire fulfilled the study inclusion criteria. Inability to fill out the questionnaire as well as incomplete data lead to exclusion.

Questionnaire

The self-administered questionnaire consisted of 118 questions. Questions assessing PTSD were strictly based on DSM-IV criteria for PTSD (15). The questionnaire investigated psychiatric symptoms, the ability to complete activities of daily living, work status, and the degree of current psychotherapeutic treatment or rehabilitation. General health status was assessed through several self-ratings with scores ranging from one ("poor") to five ("excellent").

Definitions of PTSD

Questions (n=33) assessing PTSD were based on the American Psychiatric Association (APA) DSM-IV criteria for PTSD. Most of the questions (n=23) were adopted from the Impact of Event Scale (IES) (16, 17). According to the DSM-IV, six categories of symptoms (A-F) must be evaluated to diagnose PTSD. *Category A* establishes the occurrence of a life-threatening traumatic event. Categories B-D were evaluated with the following number of questions (n): *Category B* evaluates re-experiencing the trauma, recurrent and stressful

memories, flashbacks, nightmares or intrusion (n=8); *Category* C, the symptoms of avoidance (n=9), and *Category* D evaluates the presence of arousal (n=7). Specifically, the questionnaire evaluated trauma-related psychiatric complications on a 4-point numerical scale assessing how often patients experienced these symptoms within the last month:

1) Never: 1 point
2) Seldom (once or twice per month): 2 points
3) Occasionally (once or twice per week): 3 points
4) Often (at least once per day): 4 points

The PTSD criteria for each category were fulfilled, if a score of greater than 3 points was tabulated. Criteria for *Category E* were fulfilled if the above symptoms were present for more than one month. *Category F* assessed whether the above disturbances have led to clinically significant distress or impairment in social or occupational situations. The PTSD portion of the questionnaire was based exclusively on these diagnostic categories and therefore reliably suggests the presence or absence of PTSD. Patients were then stratified into two groups: those who fulfilled the above diagnostic criteria for PTSD as well as those experiencing at least one item of the intrusion, avoidance or arousal symptom cluster and those who did not.

Statistics

Statistical analysis was performed using GraphPad Prism® statistical software (Version 7.00 for Windows, GraphPad Software, La Jolla California USA, www.graphpad.com) as well as SPSS Statistics program (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.). The data was tested for normal distribution using the Kolmogorov-Smirnov test. The ANOVA test was used to compare groups on continuously scaled variables with a normal distribution. The Kruskal Wallis test was used for non-normal distributed continuous variables with a skewed distribution. The Pearson χ^2-

test was applied to compare groups on categorical variables. Significance level was set at a p-value < 0.05 (two-tailed).

Results

Patient selection and demographics

Figure 1 shows the flow diagram of patient enrollment. Out of 637 patients that were initially enrolled (2), 36 (5.6%) patients had died and 242 (38.0%) were lost to follow-up. Of the 359 patients who received the questionnaire, 337 (93.9%) responded, 21 (5.8%) did not respond, and one patient (0.3%) returned an illegible questionnaire. The demographics are summarized in Table 1. Patients who did not contribute to this study demonstrated a similar demographic distribution (78% male, mean age at the time of injury of 26.6 ± 12.8 years and ISS of 21 ± 10 points). We found no significant differences between the population that was included in this study and those who did not contribute regarding their demographics.

General outcome

General health was reported as excellent (n=14, 4.1%), very good (n=43, 12.8%), good (n=149, 44.2%), fair (n=107, 31.8%) or poor (n=24, 7.1%). More than one third of patients (38.87%) rated their current health status as fair or poor, whereas 16.91% of patients reported excellent or very good health.

With respect to physical activity, 10 patients (2.9%) reported no capability of being physically active, 118 patients (35.0%) claimed severe limitations, 111 (32.9%) had few limitations, 46 (13.6%) minimal, and 52 (15.4%) had no limitations during physical activity.

More than one in four patients (n=88, 26.1%) experienced at least one additional psychiatric insult through further trauma or other traumatic events with 53 (15.7%) patients suffering additional severe injuries or experiencing fires or explosions. Thirty-four patients (10.0%) had to cope with life-threatening disease and 31 (9.2%) became victims of violence.

PTSD

PTSD Criterion A: Traumatic event

All patients suffered multiple injuries at least 20 years prior to the study. Average ISS was 20.3 ± 9.2. Sustaining multiple trauma, our patients suffered life-threatening injuries and criteria A for PTSD diagnosis was therefore considered fulfilled.

PTSD Criterion B: Intrusion

Nearly one in four patients (n=65/337, 19.3%) recollected past intrusive symptoms of their trauma at least once per month. Out of these sixty-five patients, sixty patients (92.3%) reported intrusion either occasionally (n=41, 63.1%) or often (n=19, 29.2%). The remaining five patients (7.7%) rarely experienced these symptoms.

PTSD Criterion C: Avoidance

Avoidance was reported in 92/337 patients (27.4%), out of which 21 patients (22.8%) frequently experienced symptoms of avoidance, 32 of them (34.8%) occasionally and 39 of them (42.4%) rarely.

PTSD Criterion D: Hyperarousal

With respect to criteria D, 95/337 (28.2%) patients suffered from hyperarousal at least once per month. Out of these, 60 patients (63.2%) experienced symptoms of arousal either weekly (n=40, 42.1%), or daily (n=20, 21.1%). Thirty-five patients (36.8%) reported to suffer rarely from hyperarousal.

PTSD diagnosis (all symptom dimensions)

In this study, 159 (47.2%) patients reported symptoms in at least one item of the intrusion, avoidance or arousal cluster. Ten patients (2.9%) reported suffering daily symptoms in all three clusters and may therefore fulfill the DSM IV diagnostic criteria of PTSD. Patients with PTSD did not significantly differ in age, gender, ISS, and Maximum Abbreviated Injury Scale (MAIS) from those not fulfilling PTSD criteria. Further, patients suffering any PTSD-related symptoms at least once per month also did not differ demographically to those with

no PTSD-related symptoms in all categories. The development of psychiatric complications was significantly associated with psychiatric treatment ($p<0.01$). Psychiatric treatment after trauma was common in all patient groups. Unemployment due to the initial trauma was significantly more likely in patients with PTSD ($p=0.009$) and those reporting symptoms of hyperarousal ($p=0.04$). Additional trauma or early retirement was not more commonly seen in those patients with PTSD or PTSD-related symptoms. These findings are summarized in Table 2.

Discussion

Traumatic injuries continue to be among the leading causes of death and disability worldwide (18). In patients surviving severe trauma, psychiatric sequelae are frequent and may lead to long term disability unrelated to their medical condition (19).

This study shows a low prevalence of full blown PTSD (3%), comparable to the life-time prevalence of PTSD in the general population (30). In contrast, nearly half of the patients suffer at least one symptom of PTSD (i.e. intrusion, avoidance, or hyperarousal) after more than 20 years after their initial injury. No association with the development PTSD or PTSD-related symptoms was observed, neither was there an association with their self-rated general health status and the injury severity or distribution.

We feel that our study has both limitations and advantages. One might argue, that the management of severely injured patients may differ from that of other institutions. However, a single center survey reduces the likelihood of inter-hospital differences in trauma management. The questionnaires were completed by the patients, and represent a subjective self-evaluation. Inability of some patients to successfully fill out the questionnaire due to older age or long-term trauma sequelae may be considered another confounding variable. However, since 93% of patients returned a properly completed questionnaire, we feel that this did not negatively affect our results. In addition, questions in our questionnaire derived

exclusively from validated questionnaires. Furthermore, the distinct possibility exists that some patients who did not consent to participate, or did not return the questionnaire, are unwilling to discuss and relive the psychiatric stress of their respective trauma. This may have caused under-reporting of a significant level of patients suffering from long-term psychiatric complications, which cannot be completely ruled out. Moreover, when the complete syndrome of PTSD is regarded as an isolated outcome measure, the statistical power may have been too low to identify significant differences (n=10 out of 337).

Finally, we could not evaluate the psychiatric influence that subsequent traumatic events experienced by our patient population had on study results.

In contrast, the questionnaire was designed, and patients were specifically instructed to focus their assessment on the initial traumatic event. We feel that further strengths of this study were the high inclusion rate of greater than 90% and the large degree of long-term follow-up data, with this data reflecting the patients' current state of health and mind.

To our knowledge, this assessment of the psychiatric complications of multiple injured patients after more than 20 years represent the longest follow-up in the literature, thus justifying our conclusions.

In this long-term follow-up study, a high percentage of patients still reported unsatisfactory general health. This is in accordance with previous studies that evaluated multiple factors including inability to return to work and socio-economic factors (12, 20). We concur with previous authors that these issues persist and do not appear to regress over time (21).

Severe injury is not necessarily sufficient to explain the development of PTSD (22). Risk factors for developing PTSD include the extent to which the traumatic event remains in the patient's memory (23), pre-trauma vulnerability (24), the magnitude of the stressor, anticipation of the event, immediate reactions to the trauma and post-trauma factors (25), as well as peri-traumatic dissociation (26). In the literature, PTSD, depression and other

psychiatric disorders may be a cause of the trauma itself through self-inflicted injuries and attempted suicide (3, 27). The present analysis of our data showed that less than 3% of patients fulfilled diagnostic criteria of PTSD more than 20 years after trauma. A wide range in the life-time prevalence of PTSD after trauma has been shown in the literature (28). This is most likely due to high variability in study design and utilization of different diagnostic criteria for PTSD (e.g. ICD-10 and DSM-5). Our long-term results of PTSD prevalence are in line with the literature, with several studies observing PTSD prevalence between 2-8% (29-32). In some studies, higher levels of PTSD in the short-term have been observed. One recent one to two year follow-up survey of 455 patients reported that 22% of patients suffered from PTSD and 24% suffered from decreased quality of life (33).

Higher rates of PTSD have been reported in soldiers with 15% of Vietnam War and 12% of Gulf War veterans still suffering from PTSD in a study published in 2011 (34). The World Health Organization's (WHO) world mental health surveys in patients who suffered traffic accidents also support our data having shown overall prevalence of PTSD after life-threatening motor vehicle collisions of 2.5% (35).

Although the prevalence of PTSD in our study population is comparable to the life-time prevalence, our data show that nearly half of patients suffering from PTSD-related symptoms at least once per month. According to this survey, these symptoms likely to be related with the initial injury, the patients suffered more than 20 years ago. It has been recently shown that the likelihood for developing these symptoms depends on the type of initial trauma (intimate and non-intimate interpersonal) (36). The type of trauma was stratified in intimate and nonintimate interpersonal trauma. PTSD related symptoms were more likely in patients who suffered intimate interpersonal trauma (36). The prevalence of PTSD bases on the simultaneous presence of all PTSD-related symptoms, yet, each individual symptom may influence the patients general quality of life. Notwithstanding a decreased diagnostic rate of

PTSD, the threshold for psychiatric consultation should be chosen appropriately according to the individual symptoms.

Conclusion

More than two decades after severe injury, a considerable number of patients were not satisfied with their physical and mental health, although no correlation between poor health and injury severity or distribution was found. While general incidence of PTSD was low, nearly half of the study population frequently reported at least some PTSD related symptoms. These symptoms as well as PTSD did not correlate with ISS or MAIS. We feel that the threshold for psychiatric counseling after trauma should be low when considering the high long-term prevalence of post-traumatic psychiatric symptoms.

Author contributions

Sascha Halvachizadeh: Writing and revision of the manuscript, analysis, interpretation of data and statistics, searched literature

Henrik Teuber: Interpretation of data, critical revision of the manuscript, searched literature

Florin Allemann: Critical revision of the manuscript

Anna Theresa Luidl: Data collection; her doctoral thesis was part of this study

Roland von Känel: Critical revision of the manuscript

Boris Zelle: Critical revision the manuscript

Simon Tiziani: Critical revision of the manuscript

Katrin Rauen: Critical revision of the manuscript

Hans-Christoph Pape: Interpretation of data and statistics, critical revision of the manuscript, establishment of the primary databank, development of study

Roman Pfeifer: Analysis and interpretation of data, statistics, critical revision of the manuscript, data collection, development of the study, searched literature

All authors read and approved the final manuscript.

Conflict of interest statement

None of the authors have any conflicts of interests to declare. The authors received no pharmaceutical or industrial support for this study. No further direct or indirect financial support or other assets were transferred to the authors or their family members for this study.

Funding

For the present 20-year follow-up, institutional funding was used. No further funding sources were utilized.

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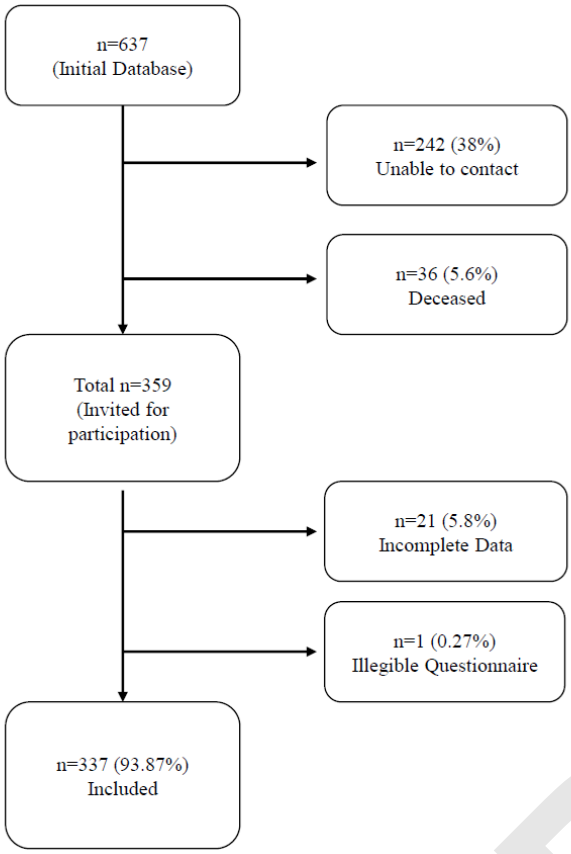

Figure 1: Patient inclusion flowchart: Initially 637 patients were included in the primary study population. Of these, 242 (38%) patients could not be contacted and 36 (5.6%) patients died. Of 359 patients invited to participate, 21 (5.85%) patients returned an incomplete questionnaire and one (0.27%) patient returned an illegible questionnaire that could not be evaluated, leaving 337 (93.87%) patients who were enrolled in this study. n=number

Demographics	
	n=337
Age (years)	25.44 (± 11.69)
Gender (male)	223 (66.0%)
Married (yes)	107 (31.7%)
ISS	20.3 (± 9.264)
MAIS 1 Head	2.68 (± 0.77)
MAIS 2 Face	1.61 (± 0.71)
MAIS 4 Thorax	3.23 (± 1.17)
MAIS 5 Abdomen	2.58 (± 0.72)
MAIS 6 Spine	2.54 (± 1.14)
MAIS 7 UpperEx	2.13 (± 0.56)
MAIS 8 LowerEx	2.77 (± 0.46)

Table 1: Demographics of patients who were included in this article. Means (± Standard deviation) for each demographic are shown. PTSD = Post-traumatic Stress Disorder, ISS = Injury Severity Score, MAIS = Maximum Abbreviated Injury Scale, ns = not significant

		PTSD-related symptoms								All PTSD-related symptoms	
	Total	None		Intrusion		Avoidance		Hyperarousal		PTSD	
	n=337	n=178	p-value	n=65	p-value	n=92	p-value	n=95	p-value	n=10	p-value
Psychiatric Treatment after Trauma	71 (21.0%)	46 (25.8%)	0.01	13 (20.0%)	ns	9 (9.8%)	0.001	7 (7.4%)	< 0.001	5 (50%)	0.01
Psychiatric Treatment before Trauma	6 (1.8%)	3 (1.7%)	ns	2 (3.1%)	ns	2 (2.2%)	ns	2 (2.1%)	ns	1 (10%)	ns
Inpatient psychiatric Treatment	27 (8.0%)	16 (9.0%)	ns	4 (6.2%)	ns	2 (2.2%)	0.01	2 (2.1%)	0.01	4 (40%)	<0.001
Retirement due to Trauma	113 (33.4%)	62 (34.8%)	ns	21 (32.3%)	ns	27 (29.3%)	ns	28 (29.5%)	ns	4 (40%)	ns
Unemployment due to Trauma	49 (14.5%)	30 (16.9%)	ns	6 (9.2%)	ns	11 (12.0%)	ns	8 (8.4%)	0.04	5 (50%)	0.009
Additional Psychiatric Insults after Trauma	88 (26.1%)	49 (27.5%)	ns	14 (21.5%)	ns	19 (20.7%)	ns	18 (18.9%)	ns	5 (50%)	ns

Table 2: Psychiatric covariates of patients who suffered from PTSD and either no, some or all PTSD-related symptoms at least once a month. Numbers (%) of positive responses for each covariate are shown. Covariate numbers in each patient group were compared to asymptomatic patients who did not report the respective covariate and PTSD-related symptom. PTSD = Posttraumatic Stress Disorder, ns = not significant.